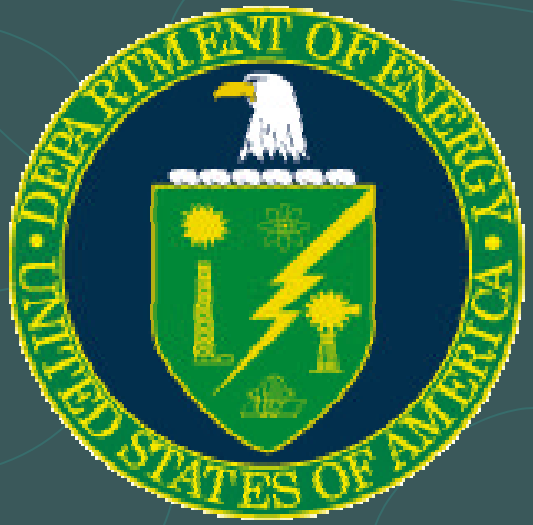
Behavioral-Based Safety in DOE



WHAT IS BBS

Behavioral safety is the application of reinforcement theory to foster an increase in "safe behavior."

Eight Principles of Behavioral Safety

- Feedback is essential to improvement
- Behavior is the cause of accidents
- Quality is built-in early in the process
- Consequences motivate behavior
- What gets measured, gets done
- Conversations change organizations
- Participation creates ownership
- Synergy comes from people working together

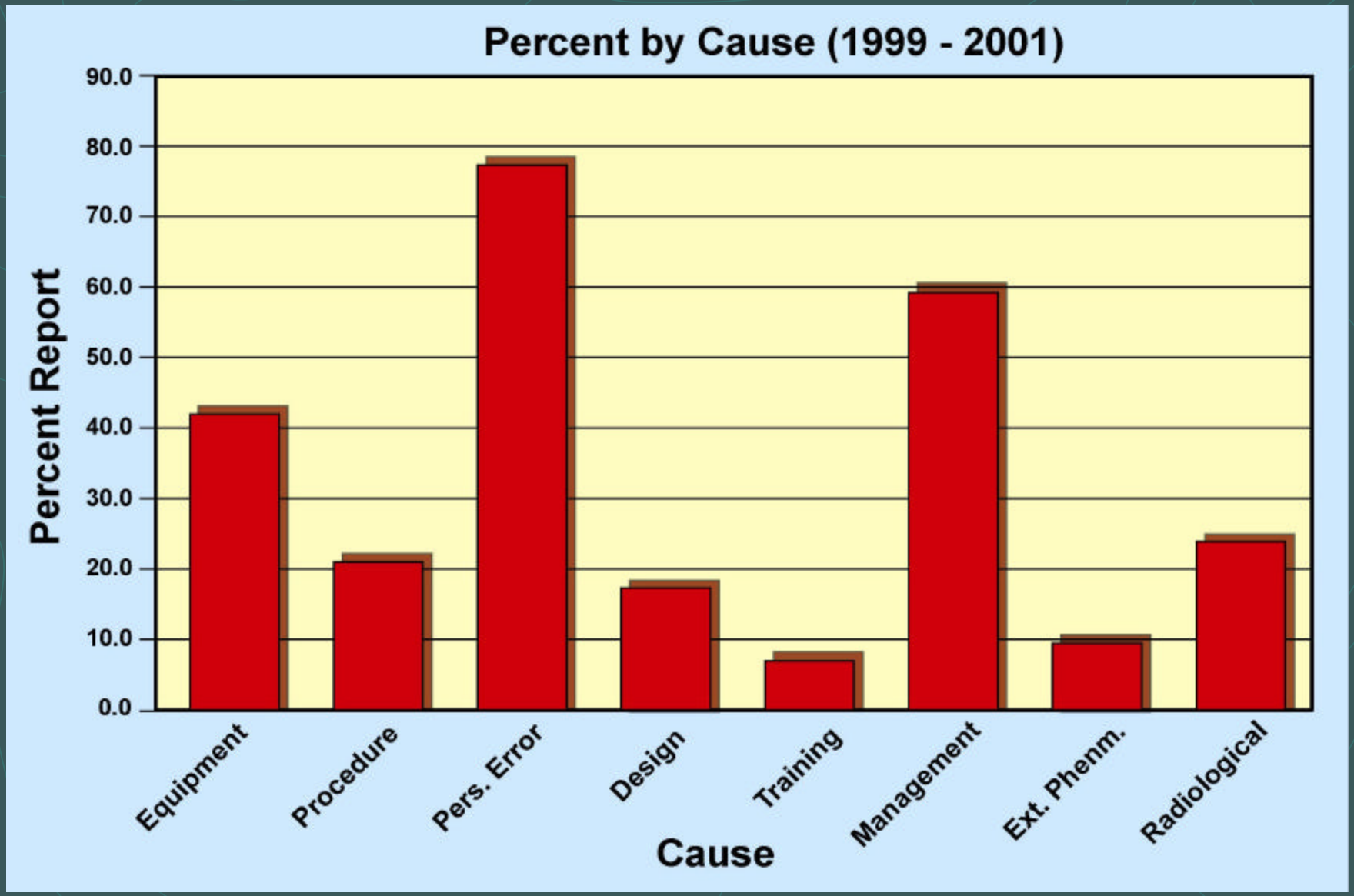
ISM and BBSP

ISMS FUNCTION	BEHAVIORAL SAFETY ACTIVITY
Define the work scope	Define the Scope of the effort; Personnel involved
Analyze the hazards	Analyze the hazardous behaviors to identify critical SAFE ACTS
Develop and implement hazard controls	Develop Critical Safety behavior Checklists and Behavioral observation methods
Perform work within controls	Train Workers/Observers; establish safe acts baseline behavior, begin observation; calculate %SAFE ACTS
Provide feedback and continuous improvement	Provide feedback to workers, observe improvement in %SAFE

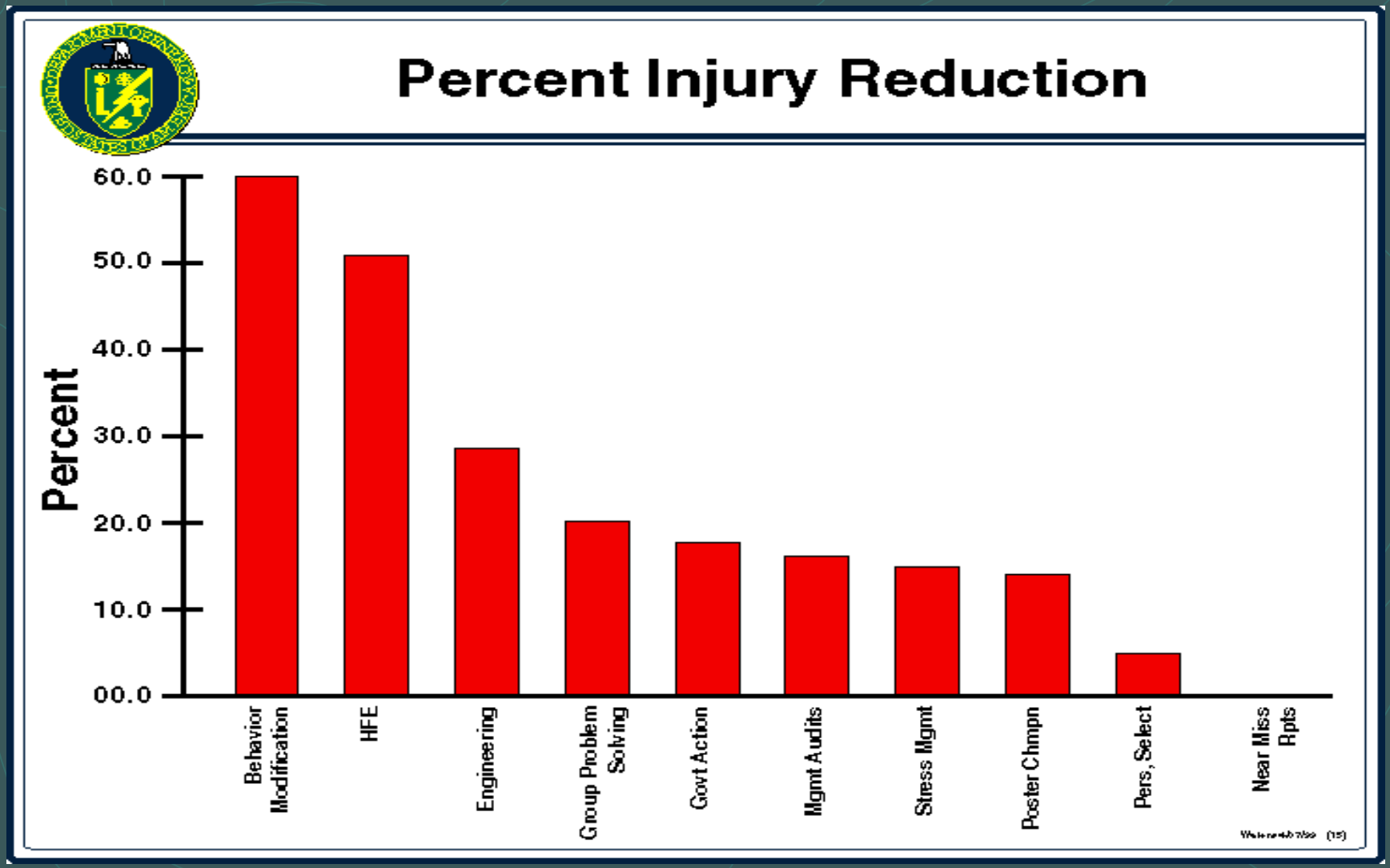
Behavioral Safety IS

- Behavior-based Safety is a method to use positive reinforcement to change *at-risk behavior*. The system:
  - Analyzes tasks and hazards to identify critical safety behaviors
  - Analyzes behavior based on job observation.
  - Uses feedback about safety performance as reinforcement
  - Is usually employee-based for continuous improvement

Causes of ORPS Reports



Effectiveness of Safety Interventions

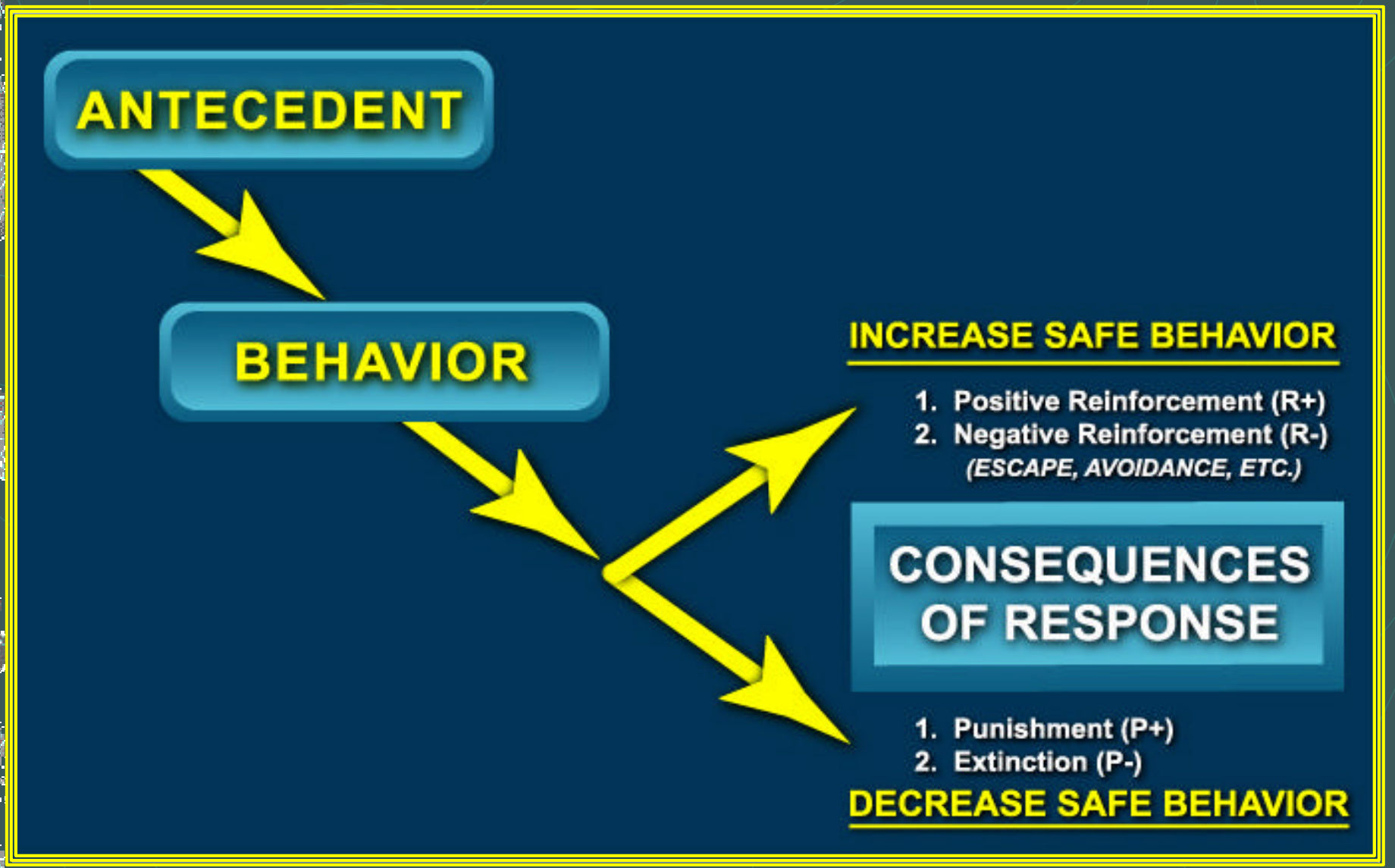


History

- 1885, Ebbinghaus noted that performance improvement occurred in list learning with feedback about answers.
- Thorndike (1898) noted that learning, a positive change of behavior, proceeded with reinforcement.
- Amplified and refined by research by Pavlov (1927) and Skinner (1930, 1938) and Hull (1943).

Reinforcement Theory

- STIMULUS
- RESPONSE
- REINFORCEMENT


ANTECEDENT
BEHAVIOR
INCREASE SAFE BEHAVIOR
1. Positive Reinforcement (R+)
2. Negative Reinforcement (R-)
(ESCAPE, AVOIDANCE, ETC.)
CONSEQUENCES OF RESPONSE
1. Punishment (P+)
2. Extinction (P-)
DECREASE SAFE BEHAVIOR

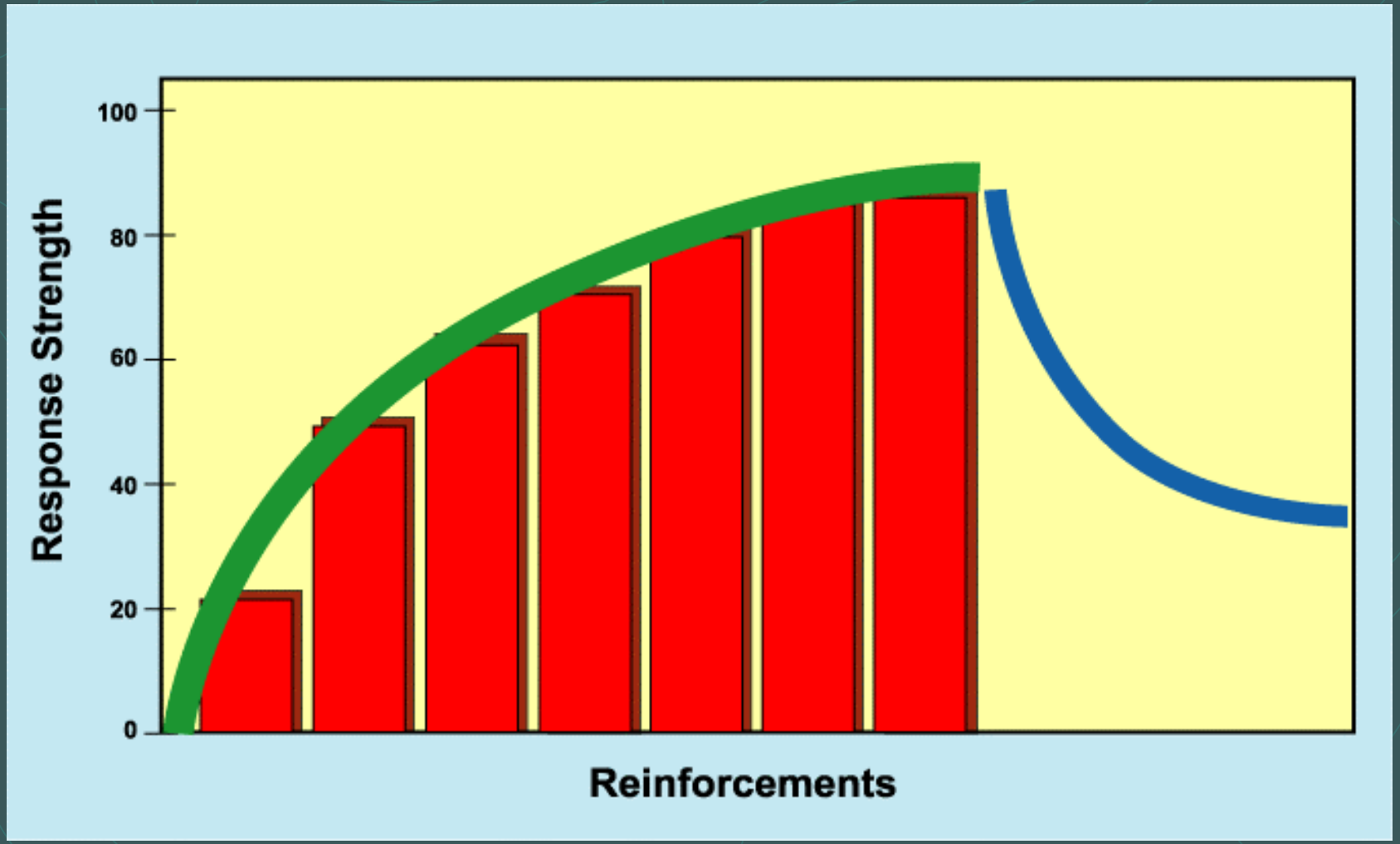
ABC Model for BBS

Antecedents: Those factors leading up to the behavior.

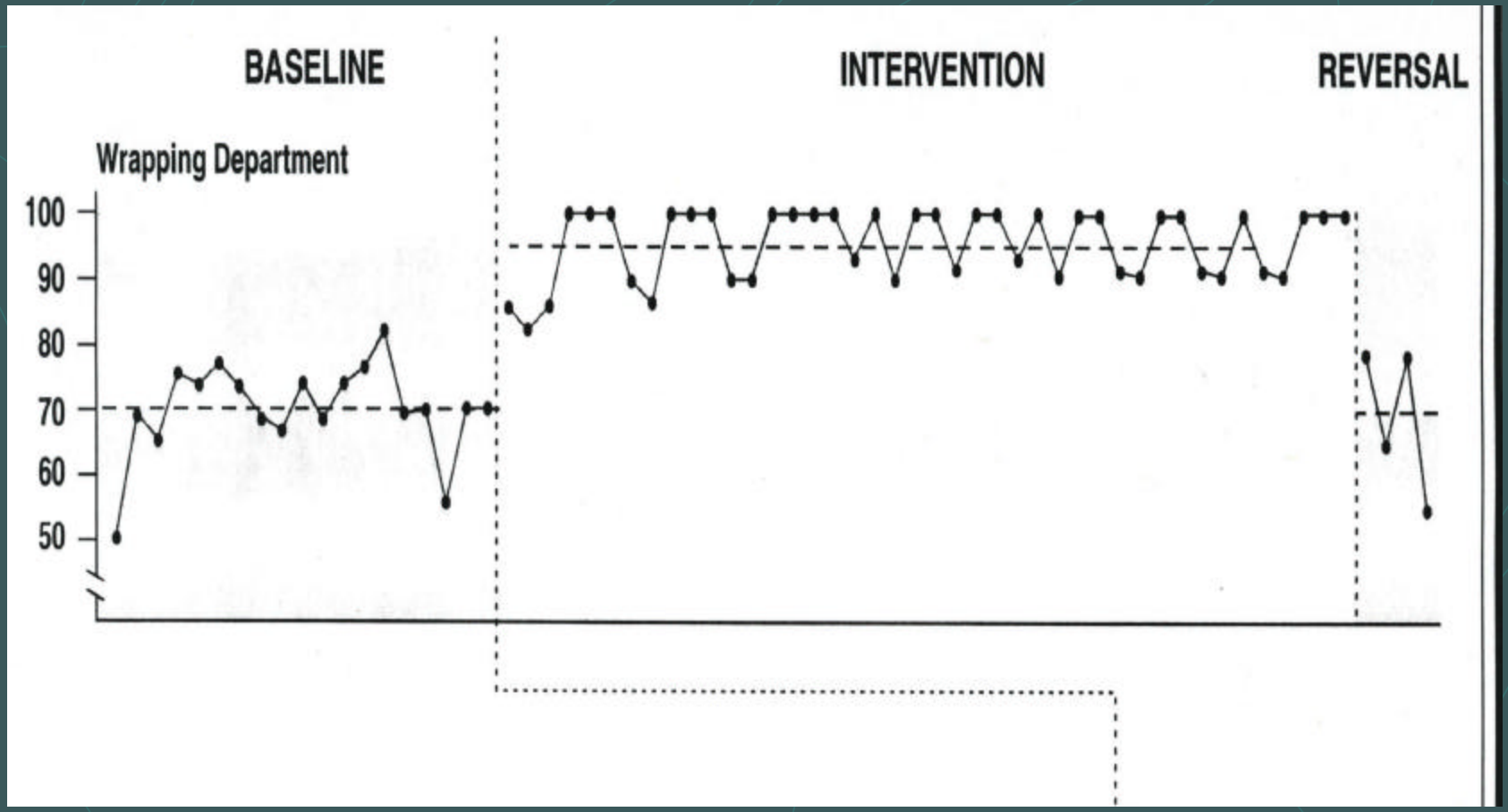
Behaviors: The safe or at-risk behaviors of concern.

Consequences: That which happens as a result of the behaviors. (Safety vs. Accidents)

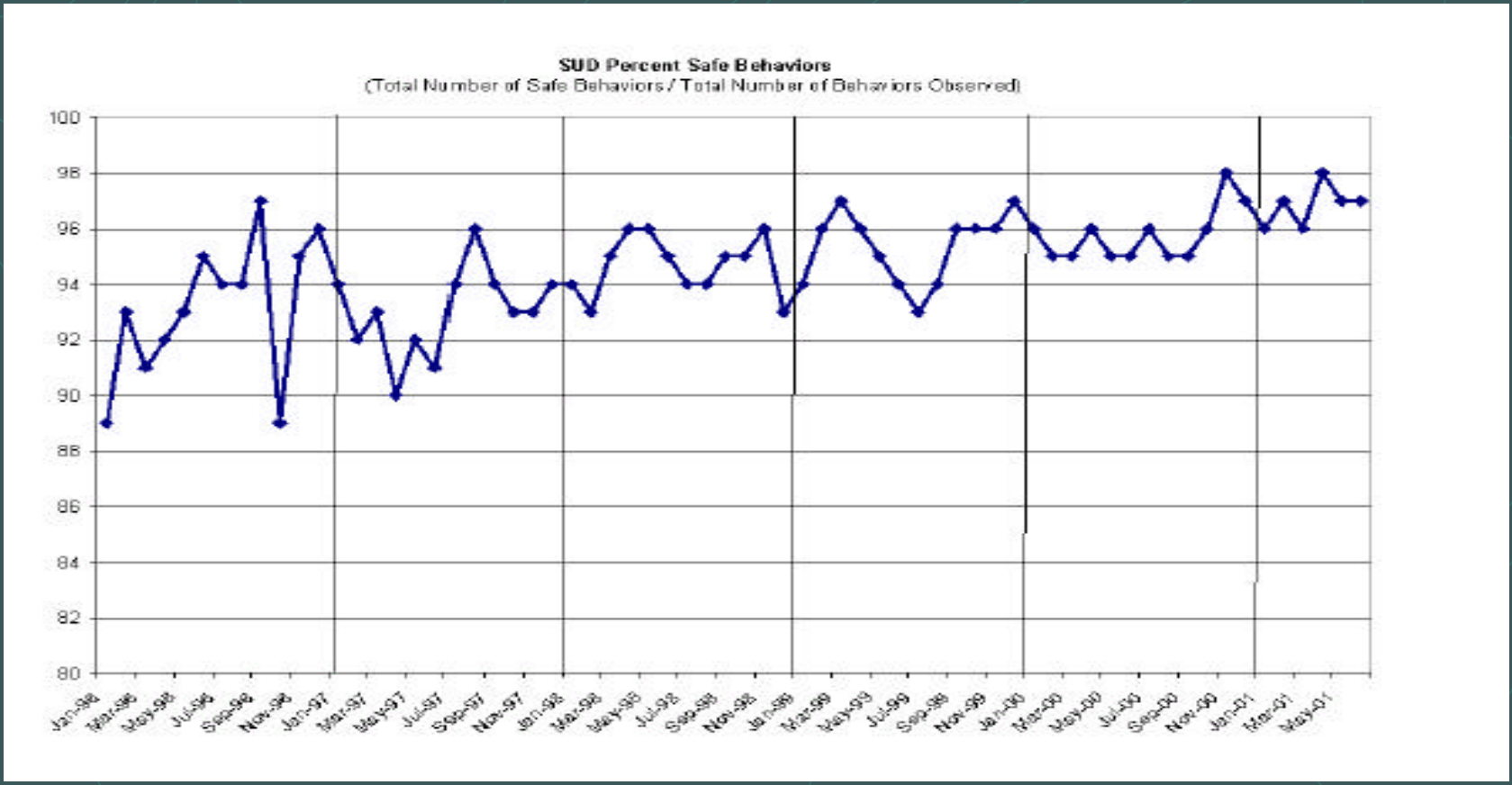
The Learning Curve



The Learning Curve – Initial BBS results



The Learning Curve - SRS-SUD %Safe Acts



Downstream Measures

- Most safety measures are Downstream measures
  - They are recorded after the incident has happened
  - They cannot be used to prevent accidents
- OSHA Measures
  - Total Recordable Cases
  - Injuries
  - Lost worktime cases

The Iceberg


FATALITIES
LOST TIME ACCIDENTS
OSHA RECORDABLES
FIRST AID
NEAR MISSES
UNSAFE ACTS

Upstream Measures

- Percent Safe Acts
  - Measured through Observation
  - Provides indication of impending safety problems
- Measure antecedent conditions for incidents
- Are related to Downstream measures favored by OSHA

Reinforcement Theory Becomes BEHAVIORAL SAFETY

- STIMULUS
- RESPONSE
- REINFORCEMENT
- ANTECEDENTS
- BEHAVIOR
- CONSEQUENCES

Behavior Modification

- 1948, Skinner talked about shaping behavior in his “novel”, “Walden Two.”
- 1950, Dollard and Miller first suggested that this reinforcement process be used to change behavior of people.
- 1960’s, Behavior Modification Used in Psychotherapy.
- 1971, Skinner’s Essay “Beyond Freedom and Dignity” called for a Technology of Behavior.
- 1978, Komaki and her associates first applied to Safety.

Behavior Technology Applied to Safety

- Heinrich (1951) 90% of all injuries are due to human error
- Dupont study supported
- FAA, 80-90% of accidents are “pilot” error

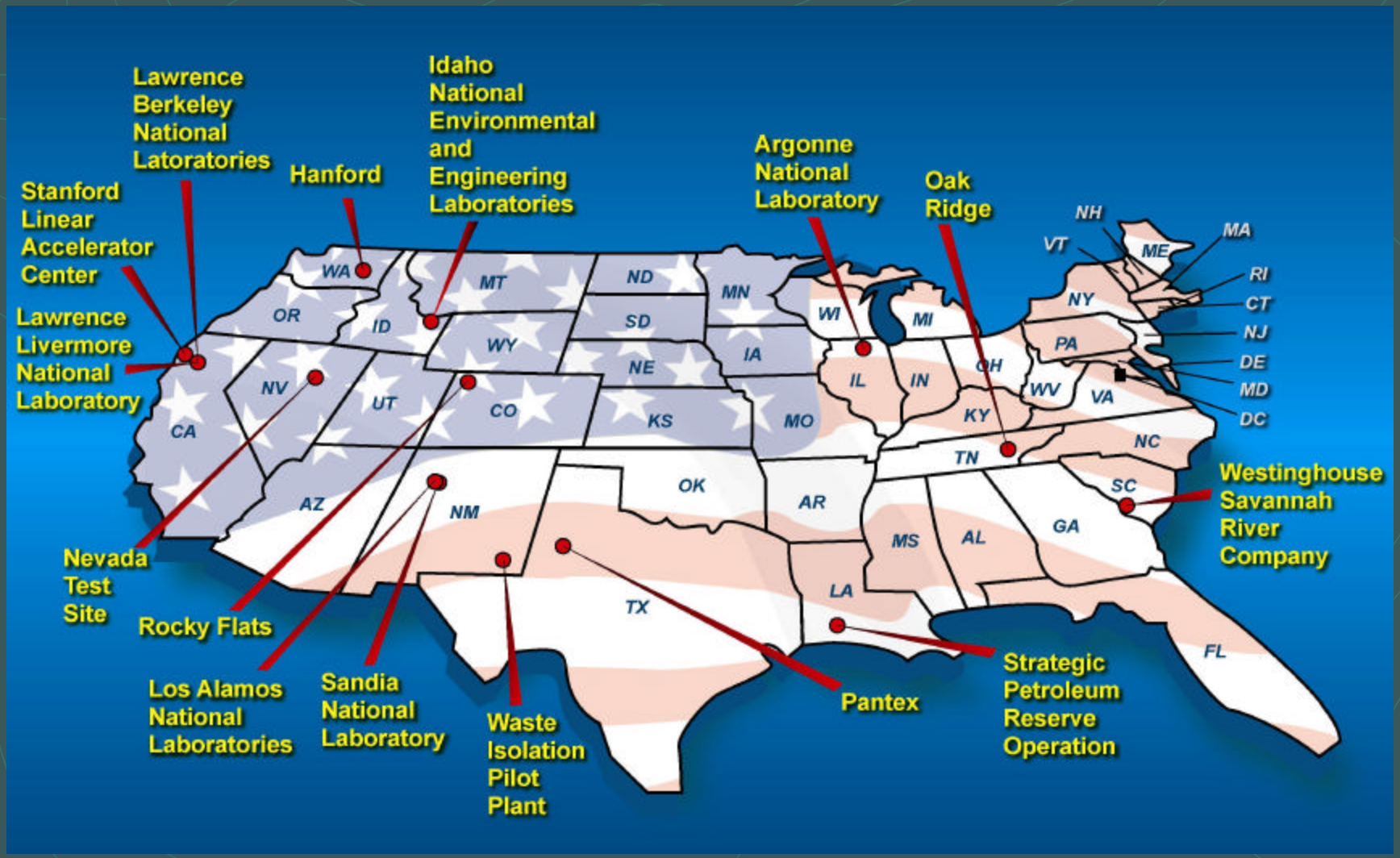
Implication is clear:

Reduce accidents by focusing on changing Behavior.

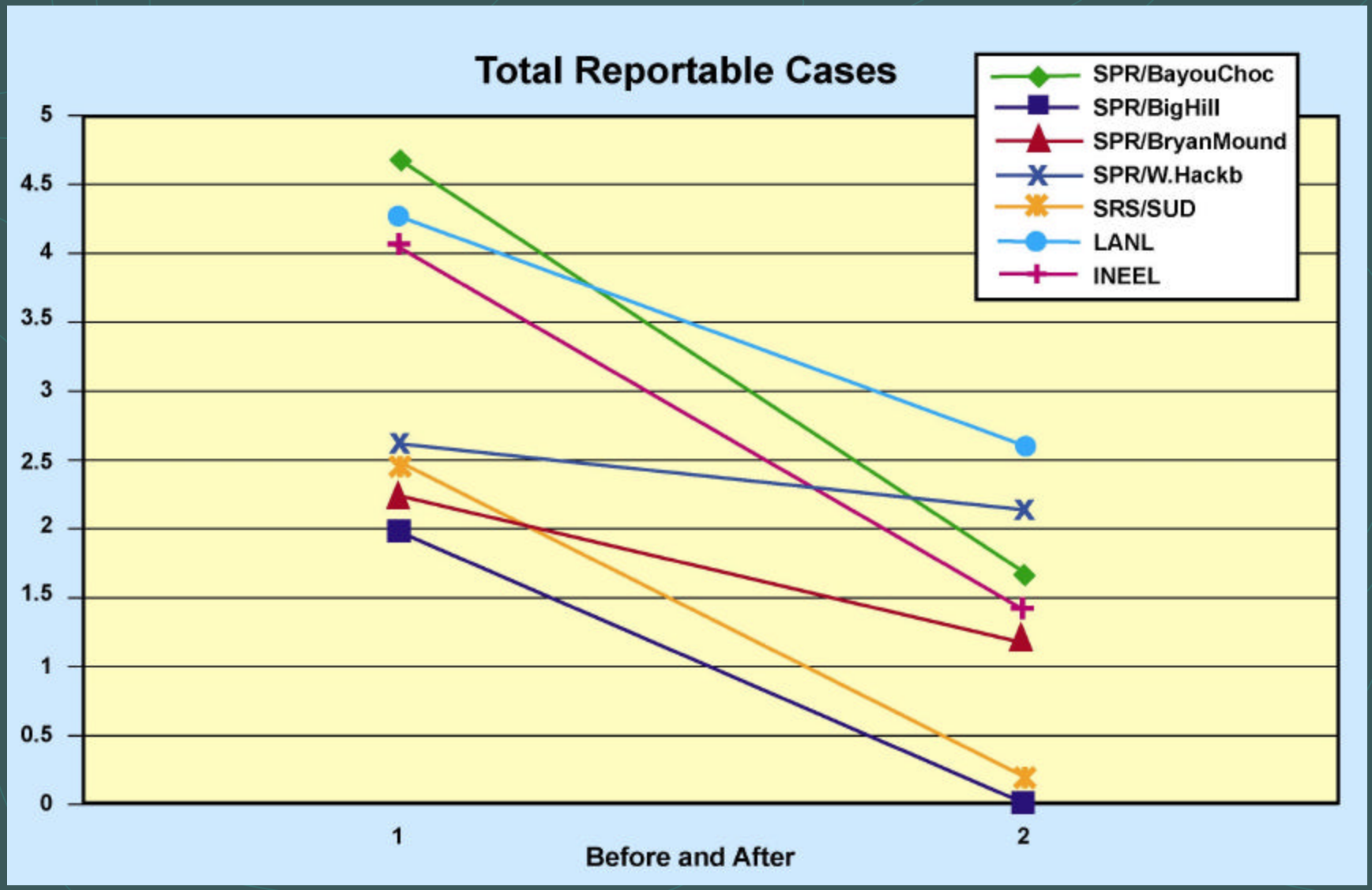
BBS within DOE

- 1990 Hanford
- 1994 SPRO, SRS, Site Utility Division
- 1998 INEEL, APS/ANL, LBNL
- 1999 SLAC, LANL,
- 2001 Pantex, Sandia
- Others: NV, WIPP, RF, OR

DOE BBS Sites



The Safety Case: TRC around DOE



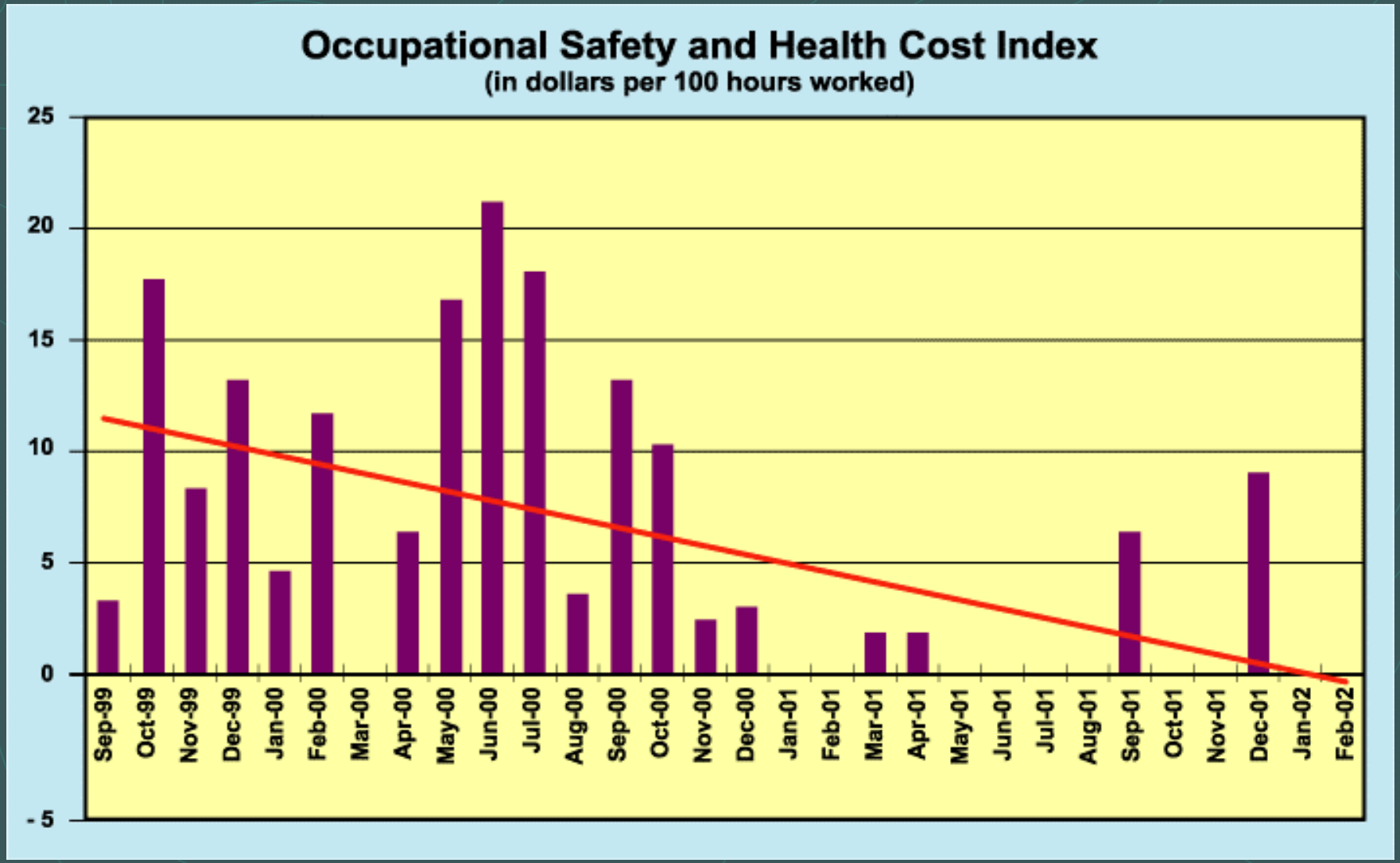
The Business Case-LBNL

- LBNL - 281% return on Investment in 2 years.
- The costs included in this data included:
  - EH&S Division's personnel time for developing the BBAP program and investigating SARs
  - BBAP software development for tracking and trending metrics
  - Retaining a consultant from Behavioral Safety Technology (BST) to certify LBNL's BBAP program
  - Purchase of BBAP videos for training coaches
  - Creation of BBAP critical behavior checklists/field booklets
  - Sending LBNL employees to BST Users Conference
  - Coaches Training
  - BBAP Committee Meetings
  - Field Observations by Coaches
  - BBAP Coaches' meetings

The Business Case-SRS/SUD

- Safety Costs went from
  - $543,200 (Yr1 Before BBS)
  - $435,813 (Yr 2)
  - $352, 259 (Yr 6) **Savings $190,940**
- Safety (TRC)
  - 2.44 (Before BBS)
  - 0.74 (Yr. 2)
  - 0.20 (Yr 6)

Business Case-SPRO



BBS Topical Commitee

- Formed in 1997 to encourage BBS growth within DOE
  - Mentoring BBS programs: bring experienced people from the complex in to help improve (start up) a program
  - Working on a BBS Handbook

http://tis.eh.doe.gov/bbs/